BEST COPY
AVAILABLE

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/760
CZECHOSLOVAKIA
February 1964
Submitted in:
ENGLISH and RUSSIAN

Confidential until official release during Conference

Abstract

Laboratory Research on Reprocessing of Irradiated Fuel in Czechoslovakia

Separation problems concerning the reprocessing of irradiated fuel have been studied on a laboratory scale in recent years, at the Nuclear Research Institute Czech.Acad.Sci. Following methods were used: liquid-liquid extraction, sorption on organic and inorganic ion exchangers, co-precipitation, the formation of radiocolloids and the distillation of fluorides.

In the field of liquid-liquid extraction, ketones were systematicaly studied and a more detailed research of the countercurrent extraction by means of methylcyklohexanone was finished, especially in the acid-deficient medium. The influence of the chain length and several function groups containing phosphorus on the separation of uranium and plutonium from the fission products was investigated for a number of phosphoorganic compounds. The Taft linear relationship was successfully used for the correlation of the extraction ability of neutral organophosphates. Further studies were made on the synergic effect of the extraction of Pu (IV) (acid and neutral organophosphate systems) and the rare earth elements (TBP, TTA, lower alcohols).

The extraction separation of uranium from fission products by means of fatty acids (C_{16-18}) in the presence of liquid paraffine and the mechanism of zirconium extraction by means of benzene solutions of the fatty acids (C_{7-9}) (the formation of colloids particles in

organic phase, the co-extraction of radioisotope traces with macroquantities of ziconium) were studied. Further investigations were made on the extraction of caesium by means of nitrobenzene in the presence of dipikrylamine, polyjodides, iodobismuthate, tetraphenylborate and heteropolyacids and the extraction of ruthenium by means of fused naphtols and tetrachloromethane (RuO_4). Several masking agents were found that improved the separation of uranium, plutonium and zirkonium during TBP extraction.

Attention was paid to the separation of uranium from fission products in aqueous medium on a column packed with divinylbenzenepolystyrene saturated with TBP and to the separation of zirconium from an organic phase (TBP in benzene) on a silicagel saturated with water.

In the field of ion exchangers, the separation of uranium on organic ion exchangers with the function groups containing phosphorus as well as the influence of organic solvents admixtures in aqueous phase on the separation of rare earths on organic ion exchangers was investigated. The sorption of uranium, plutonium and some fission products on zirkonyl and uranyl phosphates was studied also from the point of view of the mechanism (the validity of the solubility product). Much effort was made for a systematic research of heteropolyacids as selective sorbents for caesium and also of heavy metals ferrocyanids, several of which were found convenient for the reverse sorption of caesium (the repeated sorption and desorption of caesium under dynamic conditions without the sorbent dissociation). The sorption of a number of long-lived fission products was investigated on iron and manganese hydroxides and the results were interpreted from the point of view of the hypothesis of sorption complexes formation.

The behaviour of zirconium microquantities was investigated in acid solutions (2M HNO_3) in the presence of phenylarsenic acid and Arsenazo III. Anomalously high sorption on different surface areas from such solutions can be explained by the formation of radiocolloids. The method of the elementary fluorine production and the hydrofluorination of uranium having been governed, the separation of volatile uranium fluorides and the fission products on sodium fluoride was studied. The mechanism of the reaction between the uranium hexafluoride and the sodium fluoride was explained.

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/761
NORWAY
February 1964
Original: ENGLISH

Confidential until official release during Conference

Abstract

OPERATIONAL EXPERIENCE FROM THE KJELLER REPROCESSING PILOT PLANT

by

C.J. Joseph, B. Gaudernack and K.P. Lindland
Institutt for Atomenergi
Kjeller, Norway

The Norwegian-Dutch reprocessing pilot plant at Kjeller, Norway, was briefly described at the 2nd Geneva Conference in 1958 (P/585). Since June 1961 the plant has processed irradiated natural uranium fuel from the JEEP reactor at Kjeller.

The following operations are carried out in the plant: Mechanical decanning of the Al-clad fuel elements, dissolving of the decanned uranium metal in nitric acid, and liquid-liquid extraction of the uranium solution to separate uranium, plutonium, and fission products. The extraction is performed in three pulsed columns: the first for extraction of U and Pu and scrubbing of the extracted fission products; the second column for reduction and stripping of Pu and reextraction of the U following the Pu product; the third column for U stripping. The capacity of the extraction columns is about 0.5 kg uranium per hour. Most extraction runs have lasted about 30 hours.

Tributyl phosphate (TBP) diluted with kerosene was used as extractant. The maximum burn-up of the processed fuel was about 400 MWD/ton and the minimum cooling time about 30 days. Various "Purex" type flow-sheets were tested. In particular, the influence of varying feed and scrub acidities in the first column on the decontamination factors for Ru, Zr, and Nb was

studied. Also extractions with varying uranium concentrations in the feed solutions were performed. The use of 20% and 30% TBP as extractant was compared. Two series of test runs were performed for the Eurochemic Company in Mol, Belgium. The purpose of these runs was to evaluate the decontamination factors obtainable with Eurochemic's proposed flow-sheet for the first extraction cycle.
In the first series of test runs, the influence of scrub acidity on fission product removal in the first column was investigated. In the second series, the two first columns were used in a codecontamination cycle to test the Eurochemic "dual acidity scrub" flow-sheet.

In later experiments, ferrous sulphamate was replaced by tetravalent uranium as reductant for plutonium in the partitioning column. In some runs U(IV) was introduced in the top of the second column, in other runs in the middle of the column. Flow-sheets with varying U(IV)/Pu ratios were compared.

The plutonium products resulting from the first cycle experiments was collected and subsequently purified in a second Pu cycle. Various experiments were performed regarding plutonium valency adjustment in the feed solutions. Recently, the influence of various additives in the feed and scrub solutions for the first column to improve fission product decontamination has been investigated. Future plans include studies of alternate extractants and other process variables.

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/762
GERMANY, FEDERAL REPUBLIC OF
February 1964
Original: ENGLISH

Confidential until official release during Conference

Abstract

On the Experimental Region Connecting Diffusion Length and Pulsed Neutron Experiments

by

K.H. Joest, G. Memmert
Interatom, Internationale Atomreaktorbau GmbH

According to a remark of H.C. Honeck there is a gap between the area of pulsed neutron measurements and stationary diffusion length measurements, if they are described in the plane of $\lambda - v\Sigma_A$ vs. B^2. This is due to the fact that there is no absorption possible which is smaller than that of the moderator itself. If one considers the possibility of exponential experiments with sources rising with time or falling not faster than $\exp - v\Sigma_A \cdot t$ full analogy between the B^2 and $\varkappa = - B^2$ region can be established without any gap.

The exponential time variation of the flux impressed by the time variation of the source is physically equivalent to a change in the absorption of the system. Especially the decaying state corresponds to a depoisoning so that states with effective absorption smaller than $v\Sigma_A$ can be realized, which are impossible in the stationary diffusion length measurements. The increase in poisoning could be simulated by sources increasing exponentially in time. If an exponential source could be realized experimentally with sufficient accuracy, such experiments may be faster and cheaper than the stationary poison variation experiments.

The theory of asymptotic states of the form $\exp - \{\lambda t - \varkappa z\}$ has been treated for the monoenergetic and the energy dependent Boltzmann equation. The states $\exp - \{\lambda t + iBz\}$, corresponding to pulsed experiments in finite media, have been included in the analysis in order to show the strong relations between the two types of asymptotic theories.

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/763
GERMANY, FEDERAL REPUBLIC OF
February 1964
Original: ENGLISH

Confidential until official release during Conference

Abstract

On the determination of the diffusion constants of H_2O and D_2O by neutron single-scattering experiments.

by

T. Springer, S. Kornbichler and H.D. Lemmel

Institut für Neutronenphysik der Kernforschungsanlage Jülich
and Labor für Technische Physik der Technischen Hochschule München

Normally the average thermal diffusion constant $\langle Dv \rangle$ is determined by integral methods, namely by investigating the relaxation of the neutron density in time or in space. In this work a different approach has been used by measuring the differential scattering crossection $d\sigma(\theta)/d\Omega$ for different neutron energies E and sample temperatures T. From the functions $d\sigma/d\Omega$ the diffusion constant D (E, T) and $\langle Dv \rangle$ can be calculated. It has been found that the scattering cross sections $d\sigma/d\Omega$ are very insensitive to the temperature. Therefore, the quantity $\langle Dv \rangle$ can be calculated within a large temperature range by means of a comperatively small number of $d\sigma/d\Omega$ measurements. Good agreement between these $\langle Dv \rangle$-data and the more conventional experiments has been observed for H_2O and D_2O.

A/CONF.28/A/764

Readex
Fiche

Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/764
ITALY
February 1964
Submitted in:
ENGLISH and FRENCH

Confidential until official release during Conference

Abstract

A METHOD FOR SOLVING THE SPACE-ENERGY DEPENDENT NEUTRON TRANSPORT EQUATION

B. Montagnini and V. Pierpaoli
S.N.A.M. Divisione Agip Nucleare, S. Donato Milanese (Milano), Italia

A general theory for solving the space-energy dependent transport equation is developed. The method can be summarized as follows: the phase density of neutrons is expanded into a set of eigen-functions, relative to a one-velocity transport problem which contains the energy as a parameter. The Boltzmann equation is thus transformed into a set of integral equations whose unknowns are dependent on energy alone. These equations can be solved by means of a perturbation technique.

Some attention is paid to one-velocity calculation methods which make possible a good accuracy without demanding a great computational effort (such requisites are indispensable if space-energy dependent problems are to be considered).

An application to the evaluation of the resonance escape probability in heterogeneous systems is illustrated.